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(54) METHOD AND SYSTEM FOR CONVERTING EXTERNALLY DEFINED FOUR-DIMENSIONAL COLORANT TO EQUIVALENT FOUR-DIMENSIONAL COLORANT HAVING COLOR COMPONENT OF GIVEN PRINTER, AND PRINTING SYSTEM HAVING CONVERTING MEANS

(57)Abstract:

PROBLEM TO BE SOLVED: To convert an externally defined four-dimensional colorant CMYK to an equivalent four-dimensional colorant C'M'Y'K' carrying out printing, by determining a specific combination of C'M'Y'K' for a predetermined printer equivalent to the four-dimensional colorant CMYK by the same L*a*b* value.

SOLUTION: An externally defined four-dimensional colorant (CMYK) is converted to an equivalent four-dimensional colorant (C'M'Y'K') having the same L*a*b* value as the externally defined CMYK. The equivalent C'M'Y'K' has preferably a characteristic of a fourth component, e.g. black although it is originated from actual colors and efficiency of a predetermined printer executing a print function, and accordingly can be converted. In a preferred embodiment, the L*a*b* value is obtained for a predetermined combination of variable ratios of four components of the originally externally defined CMYK. The value can be

obtained through a published table of the externally defined CMYK, etc., from specifications.

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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to being a criterion or changing the 4-dimensional color (CMYK) defined in another printer into the equivalent 4-dimensional color defined as the printer which actually prints about the colors (namely, ink, a toner, etc.) related with a proper about color printing.
[0002]
[Related Art] It applies on this application and the same day, and this application relates to the applicant of this application at United States patent application (-020: internal DOKETTO number BO 9-96 United States patent application number the No. 08/823596)"A System under connection by which right transfer is carried out, Method, and and Program For Converting Three Dimensional Colorants To More Than Three Dimensional Colorants" (see as related patent application 1 below). The name of invention of the correspondence Japan patent application as a patent family is "the system, approach, and program product" which change a three-dimension coloring agent into a 4-dimensional [or more] coloring agent.

[0003] United States patent application (-024: internal DOKETTO number AM 9-97 United States patent application number the No. 08/823731)"An Enhanced System under connection by which it applies for this application on this application and the same day, and right transfer is carried out at the applicant of this application, Method, and Program For Converting An Externally Defined Four Dimensional Colorant(CMYK) Into Equivalent Four Dimensional Colorant Defined In Terms OfThe Four It relates to Inks(C'M'Y'K') That AreAssociated With A Given Printer" (see as related patent application 2 below). The name of invention of the correspondence Japan patent application as a patent family is "the system, approach, and program product" which change the coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent about four ink (C'M'Y'K') matched with a given printer.
[0004] United States patent application (-026: internal DOKETTO number AM 9-97 United States patent application number the No. 08/823734)"A System under connection by which it applies for this application on this application and the same day, and right transfer is carried out at the applicant of this application, Method, and Program For Converting An Externally Defined Four Dimensional Colorant (CMYK) Into Equivalent Four DimensionalColorant Defined In Terms Of The Four Inks(C'M'Y'K') That Are Associated With A Given Printer By Using A Three Dimensional To Four DimensionalConversion Process" (as related patent application 3 below) It relates to reference. The name of invention of the correspondence Japan patent application as a patent family is "the system, approach, and program product" which change a 4-dimensional external declaration coloring agent (CMYK) into the equivalent 4-dimensional coloring agent defined about four ink (C'M'Y'K') matched with a given printer according to a -4-dimensional three-dimension translation process.
[0005]
[Description of the Prior Art] In the additive color process (additive color process) used with a display

monitor etc., red, green, and blue are primary colors. Theoretically, mixing by red and various green and combination of a blue light generates the color of arbitration. For example, cyanogen is mixing of green and blue and a Magenta is mixing of red and blue. Black is lack of either red, green or blue, and, on the other hand, white contains three all. the color of the arbitration to which it generates a display monitor, including [therefore] the addition process (additive process) of light -- red (R) -- green -- (G) and blue (B) may define.

[0006] In a printing process, it usually already adheres to ink on sufficient quantity of red, and the blank paper which reflects green and blue. A desired color is generated red and by removing the amount of green and blue red and instead of adding green and blue (RGB) together and generating the color of arbitration. In order to carry this out, while filtering each primary color, the filter or ink not affecting must be generated by other two. The filter color which attains this is a color of the complementary color of primary color. For example, yellow is the blue complementary color. The blue filter which intercepts a blue light passes red and a green light, therefore appears as yellow. It is considered that yellow ink is ink from which blue is removed. Therefore, the blue complementary color is yellow. The red complementary color is cyanogen similarly and the green complementary color is a Magenta. So, cyanogen, a Magenta, and yellow are the primary colors in a subtractive color system, and are known for the printing industry as a process color.

[0007] Theoretically, a printer can print the color of arbitration with three colors (C), i.e., the cyanogen, the Magenta (M), and yellow (Y) of ink. White can be gained by not arranging ink on space, and black arranges cyanogen, a Magenta, and yellow on space, and can gain them by interrupting all light. However, the color actually gained when arranging cyanogen, a Magenta, and yellow on space wears not pure black but the brown taste. Black ink is consequent usually added to the set of the process color for printing. Black ink reduces the amount of the ink which it not only guarantees more vivid black, but must be used in order to generate most colors. For example, the gray component which is removed and may be permuted by the location of the arbitration on space by black when C, M, and Y of a certain amount are arranged exists. This reduces the total amount of the ink on space, and generates better gray and black. Furthermore, the color gamut of a color set is increased.

[0008] As a theoretical example of this process called a black permutation or gray component removal, I will consider the case where a certain color requires cyanogen =20%, Magenta =40%, and yellow =60%.

[0009] The aforementioned color has 20% of gray component as the least common denominator theoretically. So, 20% of each color is removed and 20% of black may permute. Therefore, the following new color mixing, i.e., cyanogen =0%, Magenta =20%, yellow =40%, black = 20% generates the same color theoretically.

[0010] The ink of 120 units is permuted by the ink of 80 units in an above-mentioned example. Therefore, ink is saved. Color ink is usually more expensive than black ink, and, so, much more saving is attained.

[0011] As mentioned above, a color may be expressed by some approaches. RGB (red, green, blue), CMY (cyanogen, a Magenta, yellow), or CMYK (cyanogen, a Magenta, yellow, black) boils a certain color comparatively, and it may be expressed more. By mixing each combination, it is related what color is generated and neither of these color spaces (called in this way) is defined. Generally, these color spaces are called device dependence (device dependent). It is because the color generated by given CMYK mixing in a certain printer does not generate the same color in another printer.

[0012] The attempt which standardizes process color ink has accomplished so that a color may be predicted in the U.S. The specification called SWOP (Specification for Web Offset Publication) which standardizes a process ink color was exhibited. Recently, this specification was improved further and the combination of 928 of CMYK was defined about what kind of color becomes the color space (CIE XYZ or CIE L*a*b*) of device independence. In Europe, the specification called Euroscale was developed to four different space. Although SWOP and Euroscale are very alike, they are not strictly the same.

[0013] The organization called CIE (Commission Internationale L'Eclairge (Commission Internationale de I'Eclariage)) was going to establish the system of a color based on the color of device independence,

i.e., people's vision, and met in 1931. While it is going to define RGB, a problem arises, and he is CIE. The member was made to persuade that data are processed through the matrix conversion which generated the color space called XYZ or XYZ. Since a XYZ color space is based on the consciousness to people's color, two colors of arbitration will be perceived by people as the same color, when a XYZ value is the same under given lighting conditions, even if the spectrums of those colors differ.

[0014] The additional color space was drawn from the XYZ color space. It is called CIEL*a*b* and these one is C. Lab or C It is pronounced with L*a*b*. This color space is based on XYZ of the color which makes reference in XYZ of the light source or paper. Almost all specifications, such as SWOP specification, are specified about XYZ and L*a*b* under the light sources, such as daylight D50. This is 3 component color space where each color is specified about L*, a*, and b*. L* specifies lightness and a hue and saturation are determined from the value of a* and b*.

[0015] As mentioned above, the color of the arbitration to which it generates a display monitor, including [therefore] the addition process of light is defined about RGB. However, a printing process is a subtraction process. It is printing of a up to [a blank paper], therefore a color printer is because various colors are generated using cyanogen (C), a Magenta (M) and yellow (Y) or cyanogen, a Magenta, yellow, and black (K), i.e., CMY or CMYK. However, input files, such as other information used in order to print a display monitor, a scanner, or an image, are usually defined using RGB. Some input files may be defined in the vocabulary of device independence, such as XYZ and L*a*b*. Therefore, the translation process for changing RGB [of an input file], XYZ, or L*a*b* into CMY or CMYK for printing needs to be carried out.

[0016] This must be changed into CMY or CMYK when an input file is RGB, XYZ, or L*a*b*. Although a printer can be printed by CMY when an input file is CMY, to print using CMYK is more more desirable. Conversion is unnecessary when an input file is CMYK.

[0017] 3D-3D conversion: It is direct, and the conversion between 3D color tables (CMY-L*a*b* etc.) and 3D color space is clear, or peculiar within the color gamut of a printer. Therefore, inverse transformation (for example, L*a*b*-CMY etc.) is usable. Such techniques form this, i.e., a CMY grid, and a corresponding L*a*b* (or other color spaces) grid (in an example here, it corresponds to CMY 9x9x9) including measurement of a color patch (for example, 9x9x9 matrices, i.e., 729 patches, are generated) of various **** in assignment spacing. These primitive lattices are shown by p (CMY) and (L*a*b*) p. Interpolation is used in order to establish the correspondence of 1 to 1 during the point in these grids. The so-called "the color rendering dictionary (color renderingdictionary)" is constituted using such a interpolation algorithm. If such a color rendering dictionary is established, it will become a simpler task to find out CMY to a given L*a*b* value.

[0018] L*a*b*-CMY conversion: The coordinate of the color space of device dependence is specified within L*a*b*. However, a printer usually uses a CMY color. Therefore, the conversion to CMY from L*a*b* is required. The conversion to CMY includes the translation process from a three dimension (3D) to a three dimension (3D). A well-known approach is used in order to perform 3D-3D conversion of L*a*b*-CMY conversion etc.

[0019] For example, L*a*b*-CMY conversion includes creation of the printing sample patch by the printer by which it asks for conversion. A printing patch consists of the combination of C, M, and Y. Usually, nine patches exist to each (the sample layout of 9x9x9 which has 729 patches is formed), and each color is 0%, 12.5%, 37.5%, 50%, 62.5%, 75%, 87.5%, and 100%. Cyanogen, the Magenta, and the rate with strict yellow are found to each of 729 patches. Therefore, each printing sample, i.e., a patch, is measured and he is the CIE. L*a*b* is calculated. The table containing CMY of various rates which has a corresponding L*a*b* value is generated. In order to express C, M, and Y, known inverse transformation and a known interpolation technique are used by the equal increment of L*a*b*. To the given L*a*b* value received as an input, a L*a*b* value is arranged in a table and the rate of corresponding CMY is found out. When the same L*a*b* value does not exist in a table, interpolation is used or mapping is used color gamut outside (out-of-gamut). Mapping color gamut outside is generated when a L*a*b* value crosses the volume or the color space of a color which can generate a printer. The L*a*b* value of the arbitration which enters in this volume may actually be correctly reproduced by the

printer. Since the given printer of arbitration has the limitation and cannot print all possible colors, as for color gamut outside, given L*a*b* means that it is outside the capacity of a printer. Much well-known mapping technique outside a color gamut exists. Fundamentally, these techniques tend to reach the nearest color-matching point on the front face of the color volume of a printer.
[0020] RGB-CMY conversion: The conversion to CMY from RGB only includes the process which only expresses the relation between the complementary color. Subtractive primaries, i.e., cyanogen, a Magenta, and yellow are the red of the primary color of additive mixture of colors, and the complementary color which is green and blue. Therefore, conversion is as follows theoretically.
[Equation 1] Cyanogen =1.0-red Magenta =1.0-greenish yellow = 1.0-blue [0021] For example, each color of 0.2 red, 0.7 green, and 0.4 blue can be expressed as 0.2= 1.0-0.8 cyanogen, 0.7= 1.0-0.3 Magenta, and 0.4= 1.0-0.6 yellow, respectively.
[0022] 3D-4D conversion : [0023] CMY-CMYK conversion: The conversion to CMYK from CMY uses the lower color removal for generating black generation and a black component. Lower color removal reduces the amount of cyanogen, a Magenta, and a yellow component, in order to amend the amount of the black added by black generation. The rate of the black used is the minimum rate used by cyanogen, a Magenta, or yellow. Next, the amount in which CMY used was changed subtracts the amount of rates used to black from the original amount.
[0024] For example, the conversion to C'M'Y'K' is as follows to the input file defined as CMY.
[Equation 2] K=min (C, M, Y)
C'=C-KM'=M-KY' =Y-K [0025] It is considered in this conversion that ink is a perfect color. Equal mixing of CMY of an amount generates black or the perfect gray of black oxide finish, i.e., a charge. Above-mentioned explanation shows the one conversion approach from CMY to CMYK.
[0026] The side effect of the conversion to CMYK from CMY is that a color gamut (color space), i.e., the number of colors generated, may be reduced by loss of a hue. This side effect may be amended by using a lower color addition process. A lower color addition process regains the lost hue, and extends a color gamut. this process -- C -- "M' -- 'Y -- the new rate of CMYK shown below as "K" is produced. A process uses the well-known formula shown in the degree originating in the classic theory.
[Equation 3]
C"=C'/(1-K)=(C-K)/(1-K)
M"=M'/(1-K)=(M-K)/(1-K)
Y"=Y'/(1-K)=(Y-K)/(1-K)
K"=K'=K [0027] RGB-CMYK conversion: The combination of a process including RGB-CMY conversion and CMY-CMYK conversion may be used for the conversion to CMYK from RGB.
[0028] L*a*b*-CMYK conversion: For the conversion to CMY from L*a*b*, this conversion contains above-mentioned 3D interpolation technique and mapping-color gamut outside technique. And this conversion included the interpolation for acquiring the CMY value over a given L*a*b* input value generation of a CMY patch (for example, 9x9x9), measurement of a L*a*b* value, and if needed. Next, the aforementioned process for the conversion to CMYK from CMY may be used.
[0029] The problem in connection with the aforementioned translation process, especially the conversion to CMYK from CMY, i.e., the conversion to 4D from 3D, is that these processes are based on a theoretical color and color relation. However, a printer may be unable to generate such a theoretical color.
[0030] Furthermore, although a printer usually has four colors of CMYK for printing, many equivalent color sets must be found out rather than three colors to all the colors from which it is gained with a combination in three primary colors since an input file is usually defined using 3 color value (for example, RGB, L*a*b*). The conversion to four dimensions or more from a three-dimension system does not offer the solution method of a proper. An above-mentioned well-known simple technique generates always perfect black or gray (w/o hue), when equivalence prints this from C, M, and Y based on the ideal color known as a charge of black oxide finish in addition to a given field top and it is carried out. Therefore, without changing a color value to the given set of arbitration in three primary colors, equivalence is removed from each color component and the black of tales doses may be added. The

amount of the ink saved is twice the amount of the black added. The amount of CMY permuted may change to the minimum value of zero to three coloring agents, and this fact shows that this process is not peculiar. In an actual coloring agent, the combination of three equivalent coloring agents does not generate ideal gray/black. Therefore, selection of a black permutation becomes ambiguous.
[0031] Said related patent application 1 indicates the technique of changing three coloring agents into four or more coloring agents. This technique takes into consideration the L*a*b* value of the color which a given printer can actually print, and a color. This technique uses the 4th color permutation process which produces the 4th amount of color permutation rates which is not ambiguous again.
[0032] It is desirable to change 4 color combination (CMYK) into 4 color combination (CMYK) with the same equivalent color depending on a situation. For example, the printing machine industry has their original specification and original specification (for example, SWOP specification) over CMYK. CMYK -- each -- ** -- specification and a specification produce a different L*a*b* value to CMYK of the same amount of rates. Furthermore, the L*a*b* value over a given CMYK combination defined by a certain specification differs from the thing to the same CMYK combination printed by the given printer of arbitration. The various toners or the ink used by the printer depends this on generating a different L*a*b* value original with them. The toner and ink which have different formulation generate a different L*a*b* value. Color combination (for example, CMYK) of the arbitration specified that it has the specific color value (for example, L*a*b* value) which does not take the property of the color of the printer which prints into consideration is made to refer to as "external declaration is carried out" here. For example, the color combination (for example, CMYK) by which external declaration is carried out is specified by SWOP specification or other specification of arbitration, or may be specified with the property (ink/toner) of another printer (it carries out for proof application). In many cases, the printer job to which external declaration of the 4-dimensional coloring agent (CMYK) is carried out is received. Therefore, the printer which prints must change the CMYK value which is received and by which external declaration is carried out into the equivalent CMYK value in consideration of the colors (namely, ink, a toner, etc.) and capacity of a given printer. If CMYK (C'M'Y'K') of a printer has the same L*a*b* value, it is equivalent to CMYK by which external declaration is carried out.
[0033] Therefore, CMYK by which external declaration is carried out is changed into the corresponding L*a*b* value, and to find out an equivalent C'M'Y'K' combination in a given printer is desired using these L*a*b* values. This conversion is shown as follows.
[Equation 4] (CMYK) STD ->(L*a*b*) STD =(L*a*b*) PRTR ->(C'M'Y'K') PRTR [0034] The problem is that mapping of 1 to 1 to CMYK from L*a*b* does not exist. That is, the combination of the proper of CMYK to given L*a*b* does not exist.
[0035]
[Problem(s) to be Solved by the Invention] Therefore, the purpose of this invention is changing into the equivalent 4-dimensional coloring agent (C'M'Y'K') in consideration of the color and capacity of a given printer performing a print facility for the 4-dimensional coloring agent (CMYK) by which external declaration's is carried out.
[0036] the proper of four colors of the L*a*b* value specified to the coloring agent (CMYK) by which external declaration is carried out to a printer of another purpose of this invention is equivalent -- combining (C'M'Y'K') -- it is finding out.
[0037]
[Means for Solving the Problem] The system, approach, and program product of a suitable example of this invention are determined by having the same L*a*b* value for the combination of the proper of C'M'Y'K' of a given printer equivalent to CMYK by which external declaration is carried out.
[0038] Another technique of attaining this is indicated by said related patent application 2.
[0039] K values each of the CMYK color combination to which external declaration of both suitable example of this invention and suitable example of said related patent application 2 is carried out -- receiving -- every -- the L*a*b* value matched with CMY combination is used. These L*a*b* values may be measured from the patch by which the printout was carried out using the ink corresponding to the specification by which is exhibited as specification or external declaration is carried out. A L*a*b*

value and the CMY value which corresponds in K values each are inputted into an inverse transformation program.

[0040] Both suitable examples carry out the map of K value by which external declaration is carried out through matching of L* value, optical density, a reflection factor, or other equivalent color values to equivalent K' value of a printer. L* is used as a color value for the sake of the convenience which describes these suitable examples. First, L* value is found out from the table released to given specification to K values each by which external declaration is carried out in C= 0, M= 0, and Y= 0. Next, a given printer carries out the printout of the patch of a series of 4th color components (for example, black) (K') of gray scale to the increment of the rate of the black (K') of the range from 0% to 100%. L* value over each of these gray-scale patches is measured. L* value and corresponding external declaration K value are inputted into a interpolation program. L* value by which the printed each gray-scale patch was measured, and corresponding K' value are also inputted into a interpolation program. Equivalent K' value can be determined from a interpolation program by comparing the same corresponding L* value to both values to given external declaration K value of arbitration.

[0041] In the suitable example of this invention, the printout of the matrix of a patch is carried out by the given printer using the ink/toner with which it asks for conversion. As for the matrix of a patch, K' has combination with the adjustable variegated rate of each component of p (C'M'Y') in 0% of rate. For example, in 0%, 12.5%, 25%, 37.5%, 50%, 62.5%, 75%, 87.5%, and 100% of combination, the printout of the matrix of 9x9x9 of C'M'Y' is carried out. However, it is not the translation which needs an equivalent increment. Next, a L*a*b* value is measured to each of these patches. It is found out to a L*a*b* value and the given L*a*b* value of the arbitration corresponding to the CMY combination to which external declaration of the K'C'M'Y to which corresponding p (C'M'Y') combination of =0 is inputted into inverse transformation / interpolation program, and corresponds' combination is carried out.

[0042] Conversion about the combination of C'M'Y'K' of a printer occurs in two parts to a given external declaration CMYK combination of arbitration.

[0043] The 1st part of conversion changes into an equivalent C'M'Y' combination of a printer the value of CMY of the CMYK combination by which external declaration is carried out. It is used as an input of inverse transformation / interpolation program together with the L*a*b* value to which the value of CMY from CMYK combination is equivalent. Inverse transformation / interpolation program finds out the L*a*b* value to which CMY of K= 0 inputted into the program corresponds from an external declaration specification. In a program, when printed by the printer through inverse transformation/interpolation, these L*a*b* values are used in order to determine the C'M'Y' value to which the printer which generates the same L*a*b* value corresponds.

[0044] The 2nd part of conversion changes into equivalent K' of a printer the value of K of the CMYK combination by which external declaration is carried out. The value of K from CMYK combination is used as an input to a interpolation program. A interpolation program finds out L* to which K inputted into the program corresponds from an external declaration specification. In a program, when printed by the printer, L* value is used in order to determine K' value to which the printer which generates the same L* value corresponds.

[0045] It is combined with the C'M'Y'K as which value was determined from 2nd part of conversion' value determined from the 1st part of conversion, and the C'M' Y'K' value of a printer equivalent to a given external declaration CMYK value is generated.

[0046] Separate three-dimension (CMY)-three-dimension (C'M'Y') conversion and separate -1 1-dimensional (K)-dimensional (K') conversion produce the solution method of a proper.

[0047]

[Embodiment of the Invention] One solution method over an above-mentioned problem is using the conversion technique of changing a L*a*b* value into an equivalent C'M'Y'K' value in a given printer, as indicated by said related patent application 1. the inside of a specification table -- or every from another external specification -- a corresponding C'M'Y'K' combination in a given printer is found out by using the L*a*b*->CMY->CMYK conversion technique indicated on these specifications to L*a*b*.

[0048] Another solution method over an above-mentioned problem is described by said related patent application 2.
[0049] The system, approach, and program product of this invention change the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the same L*a*b* value as external declaration CMYK using a different technique from what is stated by said related patent application 2. Equivalent C'M'Y'K' originates in the actual color and the capacity of a given printer to perform a print facility. In the below-mentioned suitable example, conversion is performed by saving the property of the 4th component (for example, black).
[0050] The suitable example stated on these specifications incorporates the following technique shown in drawing 1 R> 1. First, a L*a*b* value is acquired to a predetermined combination of each adjustable rate of four components of CMYK by which external declaration is carried out (step 101). These values may be acquired from a specification through the official announcement table of CMYK by which external declaration was carried out etc. For example, SWOP specification releases the table of a L*a*b* value to the adjustable rate of CMYK. When such a table is not usable, the printing patch of a predetermined combination of each adjustable rate of four components of CMYK by which external declaration is carried out needs to be gained from the printing machine using the ink of the printer corresponding to specification etc. Next, the L*a*b* value of each printing patch is measured using a spectrophotometer or other color value measuring devices. These L*a*b* values mind a look-up table and inverse transformation / interpolation program, and it is ******** with correlation to those corresponding CMYK values.
[0051] the thing (for example, SWOP) with specification releases the table which has a L*a*b* value over various combination of CMY in the 1st value of K, and a L*a*b* value (the following -- the same) over various combination with CMY same to a degree in the 2nd value of K. Independently of K value, adjustable [of the CMY value] is carried out in itself. For example, C, M, and Y have 0%, 10%, 20%, 40%, 70%, and 100% of various combination, and the CMY combination matrix of 6x6x6, i.e., 216 kinds of CMY combination, is generated to K values each. for example, it is the condition called the 1st group of 216 kinds of CMY combination of K= 0, the 2nd group of 216 kinds of CMY combination of K=.20, and 3rd group (the following -- the same) of 216 kinds of CMY combination of K=.40. every [in / in specification / K values each] -- a L*a*b* value is offered to CMY combination.
[0052] The printer by which equivalent C'M'Y'K' is desired is used for step 102 of this example. a printer -- three components (for example, the cyanogen, the Magenta, and yellow (CMY) (p and CpMpYp) of a printer) of 4 component coloring agent (CMYK) (p) -- that is, the 4th component (Kp) carries out the printout of the patch of an adjustable predetermined combination equal to 0. Usually, the printout of the p (CMY) patch of the matrix of 9x9x9 is carried out by the printer using nine kinds of rates to each color component. For example, the color patch which has 0%, 12.5%, 37.5%, 50%, 62.5%, 75%, 87.5%, and 100% of cyanogen color exists to cyanogen. Each of these rates is combined with the Magenta of these nine same kinds of rates. Furthermore, each of the combination of 9x9 of cyanogen and a Magenta is combined with the yellow of these nine same kinds of rates, and the color combination of 9x9x9 is generated. However, it is clear that a rate different here from said hung-up amount of rates may also be used. Moreover, the number of the amounts of rates used is also adjustable, and, thereby, the size of the matrix of color combination can be changed. The L*a*b* value of these patches uses a spectrophotometer or other color value measuring devices next, and is measured. A L*a*b* value and a corresponding CpMpYp value are inputted into an inverse transformation program (step 104). Next, the C'M'Y' combination to which a printer corresponds is determined by inverse transformation and interpolation to the given L*a*b* value 103 of arbitration (step 104). (CMY->L*a*b*->C'M'Y' defines this process.)
[0053] A printer prints a patch of a series of 4th coloring agent (black) (Kp) of gray scale again (step 102). Since the value of a* in a gray-scale black patch and b* is about 0, only the value of L* is used as a gray-scale black patch.

[0054] K value is investigated to given CMYK (from SWOP specification etc.). For example, I will assume that it is K=.4. From this specification existing, one of the SWOP patch in the table released or the lines has C= 0, M= 0, Y= 0, and K=.4. Corresponding L* value in K=.4 is measured from the patch which was found out from the released table or was generated from the printing machine using assignment ink. The rate of K' of a printer equal to this L* value is determined using this L* value. It is used in order that corresponding L* value measured to the gray-scale patch which has the black (Kp value) of various rates, and which was printed beforehand, and each patch may find out the rate of K' of a printer which has given L* value matched with K. In short, K value (C= 0, M= 0, and Y= 0) from specification is used together with the corresponding L* value. It is used in order that this L* value may determine K' value corresponding to a degree in a printer. pass K (SWOP) to L* -- the input of L* value to which, as for this conversion to K' (printer), all K value from specification and K values each are equivalent, and every further printed by the printer -- Kp -- comparatively -- an amount and its Kp -- based on the input of corresponding L* value which is comparatively alike and is measured by receiving, it is determined through a interpolation program.
[0055] The plot shown in drawing 5 consists of the specification K (KSTD) from 0% (0) to 100% (1), K' (K'p) of a printer, and L* value to which it corresponds from zero to 100. Such a plot is used in order to find out K' value to which the printer to given L* value or given K value of specification corresponds. This is only used correctly [the scale of a graduation] on the purpose of explanation by the plot shown in drawing 5 here. In a specific situation, although a printer may be unable to print darkest K of specification, this is compared by K'=1 and the best and the error of a result is admitted. The map-ized field in which this is applied is shown as a field 501 of drawing 5 . Although L* value over K and K' is not the same in this field, these are almost the same in this field. Even if K and K' in this field does not have same L* value, the map of it will be carried out mutually, namely, it still corresponds mutually. L* value is still almost the same.
[0056] The look-up table 107 which has C'M'Y' combination [finishing / the conversion for a printer] is generated from inverse transformation / interpolation program 104 to L*a*b*. Inverse transformation / interpolation program has the measured value of p (L*a*b*) corresponding to the adjustable predetermined value over combination and the ** (CMY) p combination of p (CMY) in the patch printed by the printer as the input.
[0057] Each combined CMY from specification (K= 0) has a corresponding L*a*b* value. These L*a*b* is used as an input to the look-up table generated as mentioned above, and the C'M'Y' combination [finishing / conversion] to which a printer corresponds is found out. Or inverse transformation / interpolation program may be used in order to gain C'M'Y' [as opposed to / without a step / L*a*b* of CMY] which generates a L*a*b*-C'M'Y' translation table. Next, the relation between given CMY of the arbitration of specification and C'M'Y' [finishing / conversion of a printer] is established by conversion to C'M'Y' through L*a*b* from CMY (it is K= 0 and K'=0 here).
[0058] Conversion is performed from an above-mentioned step between K of specification, and K' of a printer, and between CMY of specification, and C'M'Y' of a printer. Neither of the CMY or C'M'Y' combination contains K here. That is, it is K= 0 and K'=0. Therefore, the conversion (step 111) to C'M'Y'K' of a printer from CMYK of specification includes two overall processes, the separate conversion to K[from K]', and the separate conversion to C'M'Y' from CMY, (step 109). That is, K value of specification is changed into K' value of a printer through L* plot or a table, and the CMY value of specification is changed into the C'M'Y' value of a printer through a L*a*b* value. The black property of Specification K is saved in this process. In order that the L*a*b* value matched with a CMY value may find out the C'M'Y' value to which a printer corresponds as an input to inverse transformation / interpolation program to given CMYK by which external declaration is carried out through specification or another printer, it is used, and as an input to the interpolation program which uses only L* value, K value is used in order to find out K' value of a printer. The C'M'Y' value of a printer and K' value of a printer form a C'M'Y'K' value equivalent together.
[0059] In this suitable example, three-dimension-three-dimension conversion (CMY-C'M'Y') is separately carried out together with another 1-dimensional conversion [-1-dimensional] (K-K') instead

of carrying out 4-dimensional conversion [-4-dimensional] (CMYK-C'M'Y'K'). Three-dimension-three-dimension conversion produces the solution method of a proper together with another 1-dimensional conversion [-1-dimensional].

[0060] Although mentioned above about the combination of 9x9x9 kinds of patches of Cp, Mp, and Yp, the combination of a patch of the number of the arbitration of Cp, Mp, and Yp is usable. Furthermore, the color translation table developed may have the joint of a 1xmxnxo individual. 1, and m, n and o express the number of the values used to C, M, Y, and K, respectively here. Further, this color translation table increases the number of the joints to each color, and may be changed by generating a more detailed grid. For example, it shifts to the table of 16x16x16x16 from the table (CMYK->C'M'Y'K') of 9x9x9x9 (step 109). The step of this latter generates a more detailed grid table, only using a interpolation algorithm. This new translation table offers the more excellent accuracy.

[0061] Drawing 2 shows the flow chart of the process which generates a color translation table. According to [50 steps for example, of each color] the beginning, a total of 200 gray-scale patches of Cp, Mp, Yp, and Kp is printed (step 201). L*a*b* of each patch is measured and L* pair rate is plotted (step 202). Dividing linearization to N segment (a suitable example N= 8) in L* is performed to each color (step 203). Ideally, as a curve receives a* and b*, segmentation chooses spacing so that it may become a straight line mostly to L*. The data on K and Kp are inputted into a computer program (step 204). Between K value by which external declaration is carried out to various printing gray-scale values of Kp, mapping is performed based on corresponding L* value (step 205). Next, p patch (Kp=0) which has a rate with each various colors determined at step 203 (0% thru/or 100%) (CMY) is printed (step 206). Each (L*a*b*) p value of these (CMY) p patches by Kp=0 is measured (step 207). This data is inputted into a computer program next (step 208). The look-up table of CMY-C'M'Y'conversion and K-K' conversion is formed (step 211). A color translation table (CMYK-C'M'Y'K') and a file are generated (step 212). A color translation table file is transmitted and loaded to the printer control device 213 next, or it is loaded on storages, such as a diskette, (step 214). When a color translation table is memorized on a storage, a color translation table is loaded to a printer control device by the printer driver, when a printer control device memorizes eternally through a storage or it is required by the printer job (step 214 thru/or 217).

[0062] Drawing 3 is the flow chart of the computer program which generates the look-up table which derives the equivalent 4-dimensional color space (C'M'Y'K') of a given printer from the 4-dimensional color space (CMYK) by which external declaration is carried out. First, Kp value and the L*p measured value matched are read from a gray-scale patch (step 310). Next, mapping between 4th component K' of a printer and the 4th component of the 4th component coloring agent K by which external declaration is carried out is performed based on corresponding L* value (step 312). Next, the known CpMpYp value and known p value matched (L*a*b*) of printed p (CMY) patch are read (step 314). In the increment of C, M, Y, and K at equal intervals, a C'M'Y' value is acquired from a L*a*b* value through inverse transformation and interpolation, and K' value is acquired from L* value (step 322). Next, the look-up table for CMY-C'M'Y'conversion and K-K' conversion is generated (step 326). Finally, a 4-dimensional -4-dimensional (CMYK-C'M'Y'K') translation table is formed (step 327).

[0063] Drawing 4 is the block diagram showing the typical printing system which performs the device of the suitable example of this invention. moreover -- this -- it reaches, and through the printer control unit 14, other printing systems may be changed so that the device of the suitable example of this invention may be incorporated. The printing system of illustration contains the paper reel 1, the splicing table 2, the paper desiccation roll 3, the paper cooling 4, the paper condition sensor 5, the speed motor 6, the printing station 7, a top roller 8, a fixing assembly 9, the paper cooling 10, a torque motor 11, a cutter 12, and a stacker 13. The printing station 7 contains the printing engine of the order for the ink of various colors used by printers, such as cyanogen, a Magenta, yellow, and black. Furthermore, to the ink of many colors, an additional printing engine pair is contained in a printing station. As mentioned above, a computer 18 inputs color translation table data, and it is used in order to generate the color translation table file 212.

[0064] by using an above-mentioned specification, this invention may be realized as a machine, a

process, or equipment by using programming and (or) the engineering technique of the criterion for generating the combination of programming software, firmware, hardware, or those arbitration.
[0065] The program as a result of the arbitration which has a computer read-out possible program code is realized within one or more computer usable media, such as a memory apparatus or transmission equipment, and, thereby, the computer program product or equipment by this invention is manufactured. the vocabulary used here -- "equipment (article of manufacture)" and "a computer program product (or only program product)" are meant so that the computer program existing (eternal -- or -- temporarily) may be included on the computer usable medium of arbitration, such as a memory apparatus, or in transmission equipment.
[0066] Transmission of the code using direct activation of the program code from a certain medium, storage of the program code to a medium top, the copy of the code from a certain medium to another medium, and a sending set or other equivalent operations are concerned with use of memory or a sending set, and these realize a program code temporarily as the reserve which forms, uses or sells this invention, or the last step.
[0067] A memory apparatus contains semiconductor memory, such as a fixed (hard) disk drive, a diskette, an optical disk, a magnetic tape and RAM and ROM, and Prom. Transmission equipment includes the Internet, intranet, an electronic bulletin board and a message / brief article exchange, the network communication of a telephone / modem base, hard-wired one / cable type communication network, a cellular communication link, an electric-wave communication link, satellite communication and other quiescence, or a migration network system / communication link.
[0068] these contain the subcomponent or each parts of CPU, memory/store, a communication link, a communication link/transmission equipment, a server, an I/O device, or arbitration including one or more the printing systems and (or) processing systems with which the machine which realizes this invention includes the combination of software, firmware, hardware, or those arbitration.
[0069] this contractor in connection with computer Science can manufacture the computer / printer system and (or) computer / printer subcomponent which manufactures the computer / printer system and (or) computer / printer subcomponent which realizes this invention, and performs the approach of this invention by combining with a suitable general purpose or dedicated-purpose-computer hardware, and (or) printer hardware the software generated as mentioned above.
[0070] As mentioned above, although the suitable example of this invention has been explained in full detail, it will be understood by this contractor that modification and adaptation-izing of these examples are possible, without deviating from the meaning or the range of this invention.
[0071] For example, the printout of the patch of the number of arbitration is carried out, and it is measured for the corresponding color value. The matrix or the specific rate value of specific size is not required. Moreover, an increment [inequality / color / each] may be used. In this case, an increment is based on the dividing linearity step of each color. Although this invention has been described in relation to L*a*b*, the color value of arbitration including the color value of device independence may be used. Reference of L* may be optical density, a reflection factor, or other equivalent values. Moreover, although this invention has been described about CMYK (this usually points to cyanogen, a Magenta, yellow, and black), other colors may be used instead of [all] either of these color components. This invention can be applied also to 5-dimensional -5-dimensional conversion or conversion beyond it again, without deviating from the meaning and the range of this invention.
[0072] As a conclusion, the following matters are indicated about the configuration of this invention.
[0073] (1) It is the approach of changing the 4-dimensional coloring agent by which external declaration is carried out into the equivalent 4-dimensional coloring agent which has the color component of a given printer. The step which changes into an equivalent combination of said three coloring agents three components of said 4-dimensional coloring agent by which external declaration is carried out based on a color value [finishing / measurement of various combination of three coloring agents by which the printout was carried out by said printer], The step which changes into the 4th equivalent component of said printer the 4th component of said 4-dimensional coloring agent by which external declaration is carried out based on a color value [finishing / measurement of the 4th coloring agent of the adjustable

rate by which the printout was carried out by said printer], How to combine an equivalent combination of said three coloring agents with said 4th equivalent component, and contain the step which forms said equivalent 4-dimensional coloring agent which has the color component of said printer.
(2) The approach of the aforementioned (1) publication that said three components and said three coloring agents are cyanogen, a Magenta, and yellow.
(3) The approach of the aforementioned (1) publication that said the 4th component and said 4th equivalent component are black.
(4) The approach of the aforementioned (1) publication that said color value is a L*a*b* value.
(5) It is the approach of changing the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer. Three components (CMY) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out The step changed into an equivalent combination of said three coloring agents based on a L*a*b* value [finishing / measurement of various combination of three coloring agents (C'M'Y') by which the printout was carried out by said printer], The 4th component (K) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out The step changed into the 4th equivalent component (K') of said printer based on L* value [finishing / measurement of the 4th coloring agent of the adjustable rate by which the printout was carried out by said printer], An equivalent combination of said three coloring agents (C'M'Y') is combined with said 4th equivalent component (K'). The approach which L*a*b* of (CMY) approximates with L*a*b* of (C'M'Y') and K of (CMYK) approximates with K[of (C'M'Y'K')]' including the step which forms said equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of said printer.
(6) It is the approach of changing the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer. A L*a*b* value [finishing / measurement of various combination of p (CMY) by which the printout was carried out by said printer at Kp= 0:00 in three components (CMY) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out], It is based on the L*a*b* value by which external declaration is carried out to various combination of CMY at K= 0:00. It is the step changed into an equivalent combination of three coloring agents (C'M'Y') of said printer. The conversion step to which an equivalent combination of said C'M'Y' has the same L*a*b* value corresponding to said three components (CMY) at K= 0:00 of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, L* value [finishing / measurement of Kp of the adjustable rate by which the printout was carried out by said printer in the 4th component (K) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out], It is based on L* value by which external declaration is carried out to K of various rates at C= 0, M= 0, and Y= 0:00. It is the step changed into the 4th equivalent component (K') of said printer. K component at C= 0, M= 0, and Y= 0:00 of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, and identitas Or the conversion step which has almost same L* value, [said equivalent K' component] Said combination with an equivalent C'M'Y' component is combined with said equivalent K' component. It is the step which forms said equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of said printer. (CMYK) -- and (CMY) (C'M'Y'K') L*a*b* of (C'M'Y') -- approximating -- K of (CMYK) -- and (C'M'Y'K') the approach containing the formation step which L* of K' approximates.
(7) When it is the approach of changing the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer and the 4th color component (Kp) of said printer has the rate of 0, A L*a*b* value [finishing / measurement of the patch by which a printout is carried out by said printer and which has the combination of the adjustable rate of three color components (CMY) p of said printer] is used. It is the step which determines three equivalent color component combination (C'M'Y') of said printer through the inverse transformation from L*a*b* to C'M'Y', and interpolation. When the 4th coloring agent (K) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out has [said C'M'Y'] zero value, The decision step which has L*a*b* equal to three coloring

agents (CMY), A printout is carried out by said printer and L* value [finishing / measurement of the patch which has the adjustable rate of said 4th color component (Kp) of said printer] is used. It is the step which determines the 4th equivalent color component (K') of said printer. The decision step to which said K' has L* equal to the 4th color component (K) at C= 0, M= 0, and Y= 0:00 of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, How to combine said three equivalent color component combination (C'M'Y') of said printer, and said 4th equivalent color component (K'), and contain the step which forms said equivalent 4-dimensional coloring agent (C'M'Y'K').

(8) It is the approach of changing the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer. The step which inputs into a computer program the L*a*b* value by which external declaration is carried out to said 4-dimensional coloring agent at K= 0:00 of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, and a corresponding CMY combination value, By using L* by which external declaration is carried out to K value at C= 0, M= 0, and Y= 0:00 K value by which external declaration is carried out to equivalent K' value of said printer When a correlation attachment ** step and the 4th color component Kp of said printer are equal to zero value, The step which carries out the printout of the matrix of the patch which has a predetermined combination of the adjustable rate of three color components Cp, Mp, and Yp (CMY) (p) of said printer, The step which inputs into a computer program the step which measures the L*a*b* value of p combination, and the L*a*b* value of each combination of p (CMY) and (CMY) the value to which a predetermined combination of p is equivalent, (CMY) The step which determines the changed C'M'Y' combination which has the same L*a*b* value as three component CMY at K= 0:00 of said 4-dimensional coloring agent CMYK by which external declaration is carried out using said computer program, K value to which external declaration of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out is carried out -- eclipse ****** with correlation -- equivalent K' value How to use together with said changed C'M'Y' combination, and contain the step which generates a C'M'Y'K' combination equivalent to said 4-dimensional coloring agent (CMYK) by which external declaration is carried out.

(9) It is the system which changes the 4-dimensional coloring agent by which external declaration is carried out into the equivalent 4-dimensional coloring agent which has the color component of a given printer. A means to change into an equivalent combination of said three coloring agents three components of said 4-dimensional coloring agent by which external declaration is carried out based on a color value [finishing / measurement of various combination of three coloring agents by which the printout was carried out by said printer], A means to change into the 4th equivalent component of said printer the 4th component of said 4-dimensional coloring agent by which external declaration is carried out based on a color value [finishing / measurement of the 4th coloring agent of the adjustable rate by which the printout was carried out by said printer], The system which combines an equivalent combination of said three coloring agents with said 4th equivalent component, and includes a means to form said equivalent 4-dimensional coloring agent which has the color component of said printer.

(10) The system of the aforementioned (9) publication said three components and said whose three coloring agents are cyanogen, a Magenta, and yellow.

(11) The system of the aforementioned (9) publication said whose the 4th component and said 4th equivalent component are black.

(12) The system of the aforementioned (9) publication said whose color value is a L*a*b* value.

(13) It is the system which changes the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer. Three components (CMY) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out It is based on a L*a*b* value [finishing / measurement of various combination of three coloring agents (C'M'Y') by which the printout was carried out by said printer]. The conversion means corresponding to [are a means to change into an equivalent combination of said three coloring agents and (CMY)] the same L*a*b* value in C'M'Y', The 4th

component (K) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out It is based on L* value [finishing / measurement of the 4th coloring agent of the adjustable rate by which the printout was carried out by said printer]. It is a means to change into the 4th equivalent component (K') of said printer. Identitas Or a conversion means to have almost same L* value, [K and K'] The system which combines said combination with an equivalent C'M'Y' component with said equivalent K' component, and includes a means to form said equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of said printer.

(14) It is the system which changes the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer. A L*a*b* value [finishing / measurement of various combination of p (CMY) by which the printout was carried out by said printer at Kp= 0:00 in three components (CMY) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out], It is based on the L*a*b* value by which external declaration is carried out to various combination of CMY at K= 0:00. It is a means to change into an equivalent combination of three coloring agents (C'M'Y') of said printer. A conversion means by which an equivalent combination of said C'M'Y' has the same L*a*b* value corresponding to said three components (CMY) at K= 0:00 of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, L* value [finishing / measurement of Kp of the adjustable rate by which the printout was carried out by said printer in the 4th component (K) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out], It is based on L* value by which external declaration is carried out to K of various rates at C= 0, M= 0, and Y= 0:00. It is a means to change into the 4th equivalent component (K') of said printer. K component at C= 0, M= 0, and Y= 0:00 of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, and identitas Or a conversion means to have almost same L* value, [said equivalent K' component] The system which combines said combination with an equivalent C'M'Y' component with said equivalent K' component, and includes a means to form said equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of said printer.

(15) It is the printing system which has a means to change the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer. The means which carries out the printout of the matrix of the patch which has a predetermined combination of the adjustable rate of three color components Cp, Mp, and Yp of said printer when the 4th color component Kp of said printer is equal to zero value, The means which carries out the printout of two or more patches which have the adjustable predetermined rate of the 4th color component (Kp) of said printer when each of other three color components has zero value, L* value [finishing / measurement of said patches of two or more / component / 4th / of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out / (K)], It is based on L* value by which external declaration is carried out to K of various rates at C= 0, M= 0, and Y= 0:00. It is a means to change into the 4th equivalent component (K') of said printer. K component at C= 0, M= 0, and Y= 0:00 of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, and identitas Or a conversion means to have almost same L* value, [said 4th equivalent component (K')] L* value [finishing / measurement of the matrix of said patch / components / (CMY) / of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out / three], It is based on the L*a*b* value by which external declaration is carried out to various combination of CMY at K= 0:00. It is a means to change into an equivalent combination of three coloring agents (C'M'Y') of said printer. A conversion means by which an equivalent combination of said C'M'Y' has the same L*a*b* value as three components (CMY) at K= 0:00 of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, The printing system which answers the input received about said 4-dimensional coloring agent (CMYK) by which external declaration is carried out, and includes a means to print combination with said three equivalent components (C'M'Y'), and combination with said 4th equivalent component (K').

It is the system which changes the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color

component of a given printer. (16) When the 4th color component Kp of said printer is equal to zero value, When each of the step which carries out the printout of the matrix of the patch which has a predetermined combination of the adjustable rate of three color components Cp, Mp, and Yp of said printer, and other three color components has zero value, The means which carries out the printout of two or more patches which have the adjustable predetermined rate of the 4th color component (Kp) of said printer, as an input -- a -- with L* value [finishing / measurement] over each of two or more patches which has the adjustable predetermined rate of the 4th color component (Kp) b) A means to receive L* value by which external declaration is carried out to the adjustable rate of said 4th coloring agent (K) by which external declaration is carried out, The computer program which has a means to generate the file of correlation attachment **** 1 based on the received input for the 4th color component to which said printer corresponds said 4th coloring agent by which external declaration is carried out and which is loaded to a computer, as an input -- a -- with a L*a*b* value [finishing / measurement of each patch of the matrix of the patch which has three color components printed by said printer] b) A means to receive the L*a*b* value by which external declaration is carried out to the combination of the adjustable rate of other three color components by which external declaration is carried out, Said inverse transformation of L*a*b* and interpolation which correspond for carrying out external declaration (CMY) are led. It is correlation attachment ** (namely, it is conversion of CMY-L*a*b*-C'M'Y') to the combination to which three color components of said printer correspond three given coloring agents of said 4 component coloring agent by which external declaration is carried out. Said computer program loaded to said computer by which CMY and C'M'Y' has a means to generate the 2nd file matched with the same L*a*b* value, It is generated by said computer and based on said 2nd and 1st files loaded to said printer control unit. The system containing the printer control unit which changes said 4-dimensional color component by which external declaration is carried out into the 4th color component to which three color components of said printer are equivalent, and which combines and corresponds.

(17) Change the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer. It is a file on the medium used within the printer control unit of said printer. Three components (CMY) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out It is based on a L*a*b* value [finishing / measurement of various combination of three coloring agents (C'M'Y') by which the printout was carried out by said printer]. A means to change into an equivalent combination of said three coloring agents corresponding to the L*a*b* value matched with said CMY by which external declaration is carried out, The 4th component (K) of said 4-dimensional coloring agent (CMYK) by which external declaration is carried out It is based on L* value [finishing / measurement of the 4th coloring agent of the adjustable rate by which the printout was carried out by said printer]. It is a means to change into the 4th equivalent component (K') of said printer. Identitas Or a conversion means to have almost same L*, [K and K'] The file which combines said equivalent combination of C'M'Y' with said equivalent K' component, and includes a means to form said equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of said printer.

(18) Change the 4-dimensional coloring agent (CMYK) by which external declaration is carried out into the equivalent 4-dimensional coloring agent (C'M'Y'K') which has the color component of a given printer. Generate the file used within the printer control unit of said printer. It is a program product realizable on a computer usable medium. A means to receive L* value [finishing / measurement] over each of two or more patches printed by said printer which has the adjustable rate of the 4th coloring agent (Kp) of said printer as the 1st input, A means to receive L* value by which external declaration is carried out to the adjustable rate of said 4th coloring agent (K) by which external declaration is carried out as the 2nd input, A means to provide by determining L* value which adjusts the 1st correlation between said 4th coloring agent by which external declaration is carried out and 4th color component to which said printer corresponds based on said input in which the 1st and the 2nd were received, A means to receive the L*a*b* value [finishing / measurement of each patch of the matrix of the patch printed by said printer] which has a predetermined combination of each adjustable rate of other three coloring

agents of said printer as the 3rd input, A means to receive the L*a*b* value by which external declaration is carried out to the combination of the adjustable rate of said three color components of the others by which external declaration is carried out as the 4th input, Said 1st correlation between three given coloring agents of said 4 component coloring agent by which external declaration is carried out, and the combination to which three color components of said printer correspond, and the 2nd different correlation A program product including a means to provide by determining the L*a*b* value to adjust based on said input in which the 3rd and the 4th were received.

[Translation done.]